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Complete Car Care Manual

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Maintenance / Air cleaners

Periodic checks

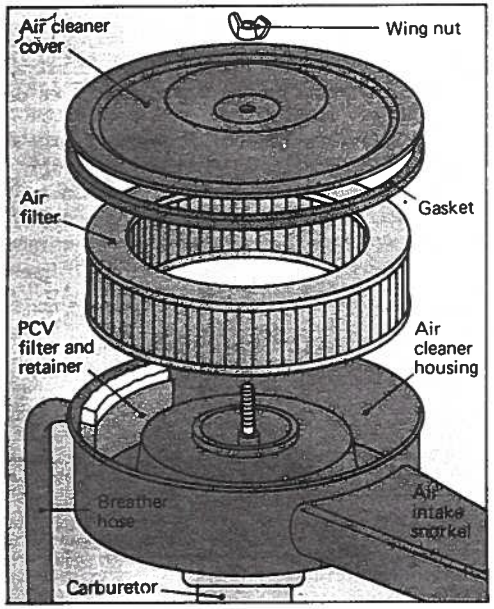
From a simple filter mounted on top of the carburetor, the air cleaner has evolved into a complex, thermostatically controlled unit that is part of the car's emission-control system (p.56). Although most air cleaners are mounted on the carburetor, some—especially in fuel-injected or turbocharged engines—are mounted in remote positions (see opposite page). To locate these remotely mounted units, trace the large duct from the carburetor or the fuel-injection system's intake manifold to the air cleaner.

Air cleaners have always required periodic maintenance. The filter inside the housing should be removed and inspected every 12,000 miles (20,000 km). If the filter is wet, damaged, or very dirty, it should be replaced with a new one designed specifically for your engine. Running your car with a clogged filter could result in hard starting, stalling, and poor gas mileage. A damaged filter can cause excess engine wear. When inspecting the air filter, you should also remove and inspect the positive crankcase ventilation (PCV) filter and, if necessary, replace it with a new one. Instructions for servicing the thermostatic controls are on pages 242-243.

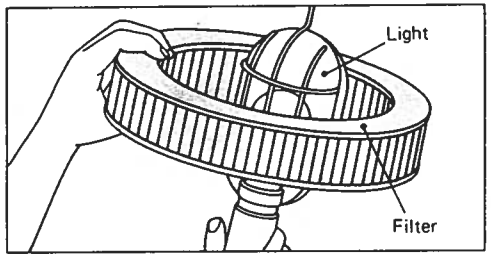
In order to perform certain jobs, you will have to remove the entire air cleaner assembly, not just the filter. This usually involves disconnecting several hoses and various clamps that are attached to the snorkel, sides, and underside of the air cleaner (see below). Until you are completely familiar with the air cleaner in your car, label each hose and its attachment point on the air cleaner so that you will be able to reassemble the unit properly.

Tools: Pliers, wrenches, screwdrivers.
Materials: Droplight, compressed air, masking tape, pencil or pen, clean rags.

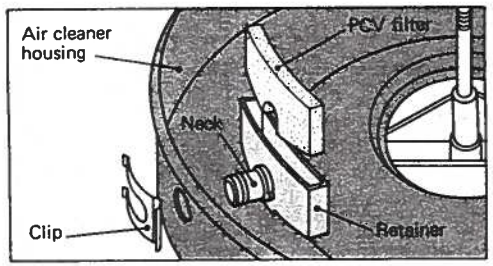
Removing and inspecting air filters and PCV filters — 10–30 min



1. Locate the air cleaner. It is usually on top of the carburetor; for variations, see opposite page.
2. Remove the cover from the air cleaner. Cover is usually held in place by a wing nut or by bolts, nuts, or clips. If any hoses attached to the cover interfere with its removal, disconnect them first.
3. Lift out the air filter and inspect it for dirt, tears, or damage. Replace filter if necessary.
4. Remove and inspect the PCV filter; if necessary, replace it with a new one.
5. Reverse removal procedure to reinstall PCV filters and air filters. Secure the cover of the air cleaner.

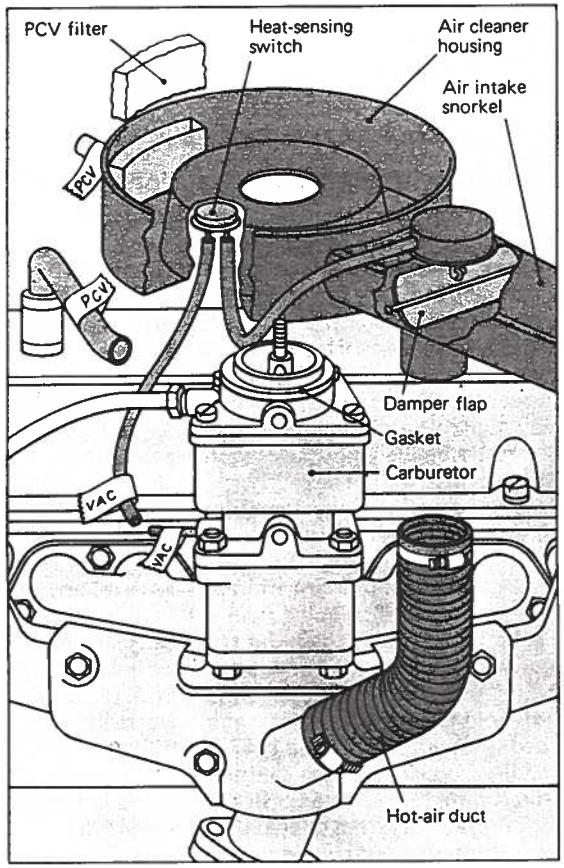


To inspect most air filters, hold a light to the inner side and revolve the filter around the light. If you can see light through the entire filter, it is clean and may be reused. If the filter is slightly dirty, it can be reused after you remove the dirt. To dislodge and remove the dirt, gently tap the filter against a flat surface or blow compressed air through it. If the air filter is so dirty that you cannot see light through it—or if the filter is torn, damaged, or wet—replace it with a new one.



To remove a PCV filter, remove the clip holding the crankcase breather hose to the air cleaner, and pull the hose from the neck of the PCV filter's retainer. Pull filter retainer away from the side of the air cleaner, then slip the filter from the retainer. Inspect the filter; if it is wet, clogged, or very dirty, replace it.

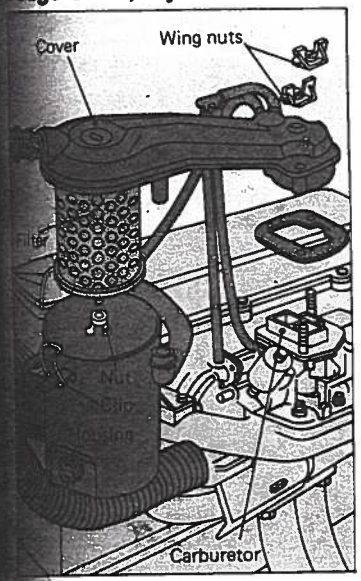
Removing an air cleaner — 10–30 min



1. Remove the air cleaner cover. Remove and inspect air and PCV filters; replace if necessary.
2. Free any clamps and disconnect any ducts and hoses that interfere with removal of air cleaner. If several hoses must be disconnected, use masking tape to label the hoses and the nipples to which they are attached. This will help you reconnect them properly.
3. Remove any nuts or bolts holding air cleaner to engine. Lift air cleaner off the carburetor.
4. Inspect all ducts, hoses, and lines that were disconnected. Replace any that are damaged.
5. Inspect the gasket between the air cleaner and the carburetor; if it is cracked or soaked with oil, replace it.
6. Wipe the inside of the housing and cover clean.
7. Reverse order of removal to reinstall filters and cleaner.

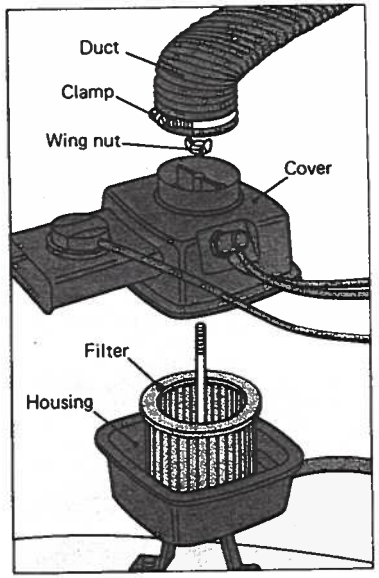
Removing specific types of air filters ⏱ 10–30 min

Dodge Omni, Plymouth Horizon



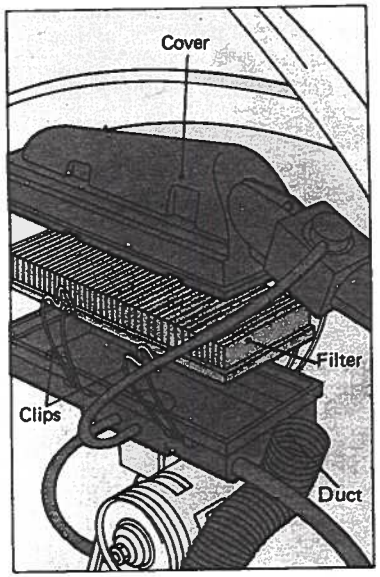
Omnis and Horizons have a canister-like air cleaner next to the carburetor cover. The air cleaner extends to the carburetor.
To remove the filter:
1. Remove the two wing nuts holding the cover to the carburetor. Unsnap the two clips that hold the cover to the air cleaner.
2. Lift off the cover; the air filter will come with it.
3. Remove the wing nut at the bottom of the filter, and slip the filter off the rod.
4. Inspect filter and clean or replace it.
5. Reverse order of removal to reinstall the filter.

GM cars with turbocharged V-6 engines



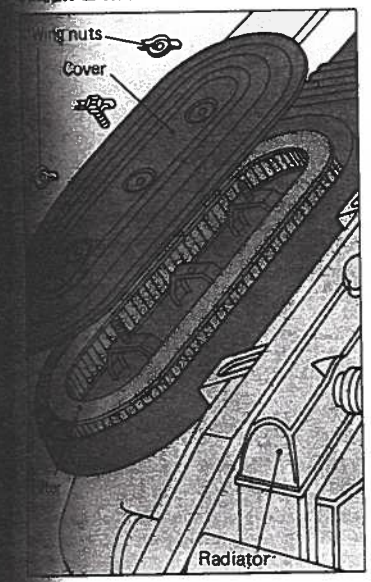
In GM cars with turbocharged V-6 engines, the air cleaner is mounted next to the engine and is connected to the carburetor by a duct. To remove the filter:
1. Loosen the clamp that holds duct to cover of air cleaner. Pull the duct off.
2. Remove wing nut holding cover in place. Lift cover off housing.
3. Lift out and inspect the filter (opposite page) and clean or replace it.
4. Reverse order of removal to reinstall the filter.

VW Super Beetle



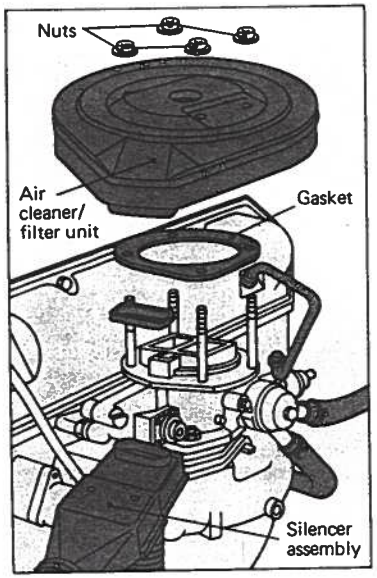
VW Super Beetle and several other imported cars have rectangular air cleaners that may be attached to the carburetor (as shown) or remotely mounted and attached to the carburetor by a duct. To remove this type of filter:
1. Open the wire clips by hand.
2. Disconnect hot-air duct and lift cover.
3. Lift out and inspect the filter (opposite page) and replace it if necessary.
4. Reverse order of removal to reinstall the filter and cover.

Datsun Z models



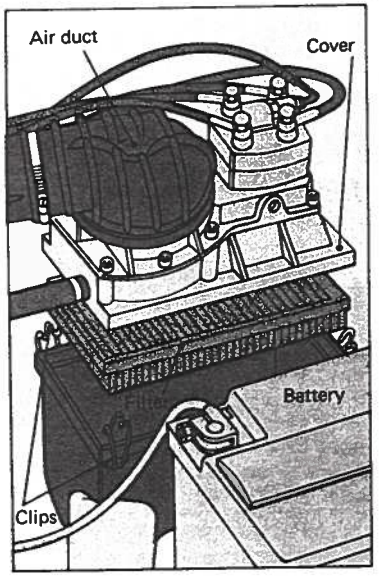
The air cleaner is mounted in front of the radiator on Datsun 240Z, 260Z, 280Z, and 280ZX cars. It is connected to the carburetor or fuel-injection system by a duct. Early models have an oval filter; late models, a rectangular filter.
To remove the filter:
1. Remove the wing nuts or wire clips that hold the cover in place.
2. Lift the cover off the housing.
3. Lift out and inspect the filter, and clean or replace it.
4. Reverse order of removal to reinstall the filter.

GM sealed air cleaners



Some GM cars with four-cylinder, overhead cam engines have a sealed air cleaner. The filter cannot be inspected; you must replace the entire unit at 50,000-mile intervals, or sooner if the car exhibits signs of a clogged filter.
1. Remove the bolt or nuts that hold unit to carburetor.
2. Disconnect the silencer assembly and lift the unit out.
3. Inspect gaskets and grommet; replace them if they are wet, cracked, or damaged. Colored side of gasket must face carburetor.
4. Reverse order of steps to install unit.

VW Rabbit with fuel-injected engine



In fuel-injected VW Rabbits the air cleaner is mounted behind the battery. To locate the air cleaner, follow the air duct from the intake manifold. To remove the filter:
1. Unfasten the clips at the back and front of the air cleaner.
2. Lift cover off housing; the fuel distributor and filter will come with it.
3. Pull filter off cover and inspect it (opposite page). Clean or replace the filter.
4. Reverse order of removal to reinstall the filter.

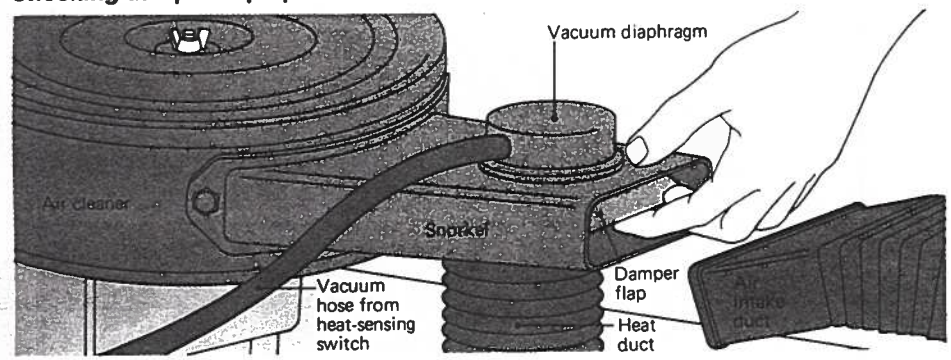
Heat-controlled air cleaners

The heat-controlled air cleaner system (p.56) functions as part of the car's emission-control system; basically, it serves as a preheater for the air in the carburetor. By keeping the temperature of the air that enters the carburetor within a specific range, the carburetor can run much leaner, and pollution emissions are reduced. The heat-controlled air cleaner system also improves the drivability of a cold engine; some systems have an additional control that operates during acceleration, when engine vacuum is low (see *Additional controls*, opposite page).

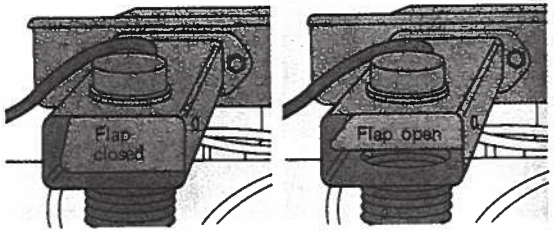
The heat source for the system is the exhaust manifold. A sheet-metal duct, called a *stove*, around the manifold collects the heat and directs it through a duct connected to the air cleaner's snorkel. The snorkel is also connected to an outside-air intake duct. A damper flap inside the snorkel controls the proportions of heated or outside air that enters the air cleaner and the carburetor. The damper flap may be moved by a mechanical thermostat inside the snorkel, or by a heat-sensing switch inside the air cleaner plus a vacuum diaphragm, called a *vacuum motor*, on top of the snorkel. Loss of engine power or an engine that runs unevenly until it warms up may indicate a poorly operating damper flap. Check the operation of the damper flap at every tuneup. If you cannot see the flap, reach inside the snorkel with a pencil to feel the flap move.

Tools: Long-nose pliers, screwdrivers, drill and drill bits, small sheet-metal screws.
Materials: Replacement parts as needed.

Checking damper flap operation

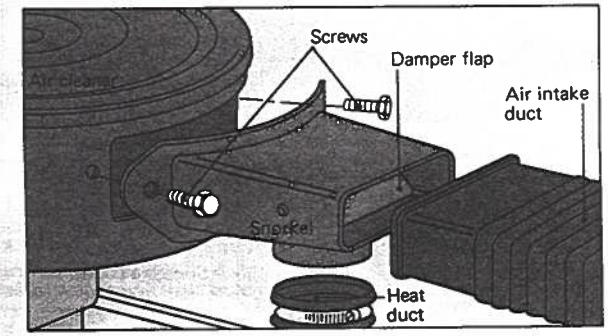


1. Check that the damper flap can move freely inside the snorkel. Remove the air intake duct (if any) from the snorkel; it is usually held in place by clips or by clamps. Then gently work the flap by hand. If the flap sticks, clean off any dirt from the inner walls of the snorkel.

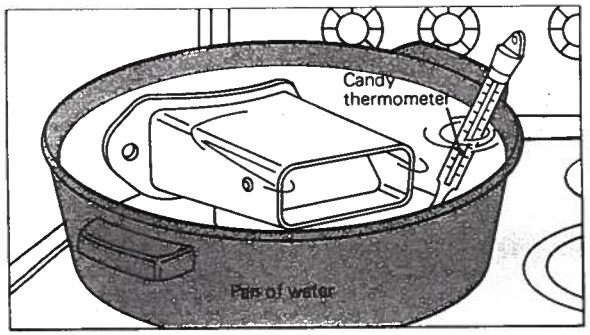


2. Check the damper flap while engine is running. When the engine is cold, the flap should be closed to outside air (left); when the engine is hot, the flap should open (right). If the flap does not move, there is a problem with the controls.
Caution: Do not touch hot or moving engine parts.

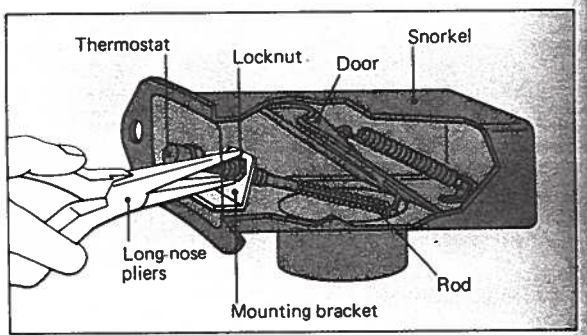
Testing a thermostatically operated damper flap 30 min–1½ hr



1. With the engine off, remove the snorkel. Disconnect heat duct and air intake duct from the snorkel, then remove the screws holding the snorkel to the air cleaner. If snorkel is part of the air cleaner, remove the air cleaner (p.240). If the spring is disconnected from the damper flap, use long-nose pliers to reconnect it.

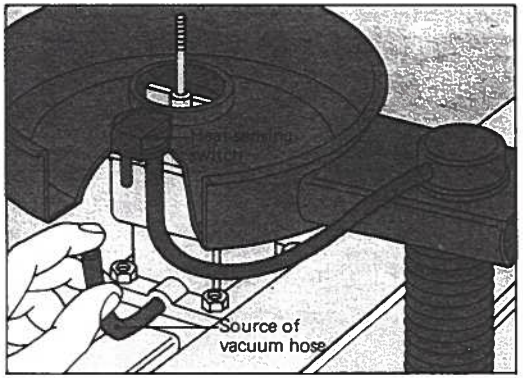


2. Immerse snorkel in a pan of water, making sure that the thermostat is covered. Insert a candy thermometer, then heat the water. The flap should be closed when water temperature is below 105° F (40° C), open when temperature exceeds 130° F (54° C). If flap does not move, replace the thermostat or snorkel.

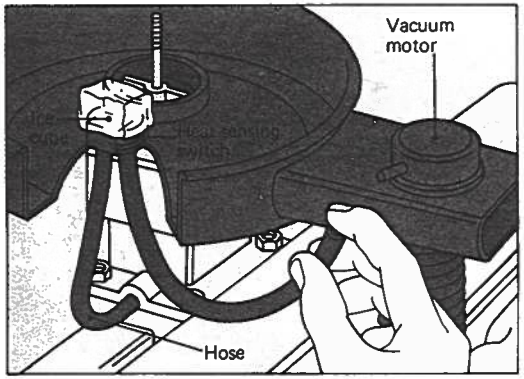


To replace thermostat, use long-nose pliers to loosen locknut. Unhook door rod. Unscrew stat and pull it out. Note position of the locknut, then remove it and screw it onto the new thermostat to exactly the same position. Screw new stat into mounting bracket; reattach door rod. Unscrew stat until door closes. Tighten locknut.

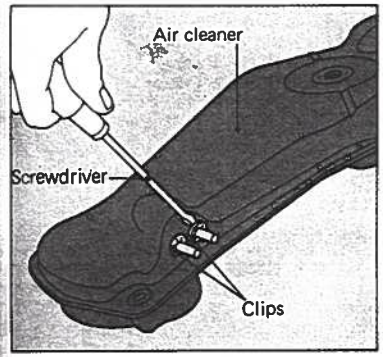
Testing a vacuum-operated damper flap 30 min–1½ hr

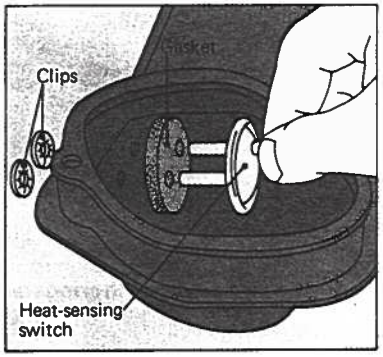


1. Remove air cleaner's cover and filter (p.240). Disconnect the vacuum hose from the heat-sensing switch. Turn on the engine and feel for vacuum. (**Caution:** Do not touch hot or moving engine parts.) If there is no vacuum, turn off the engine. Check that the hose is on tight. If hose is cracked, replace it. Reconnect the hose to the switch.

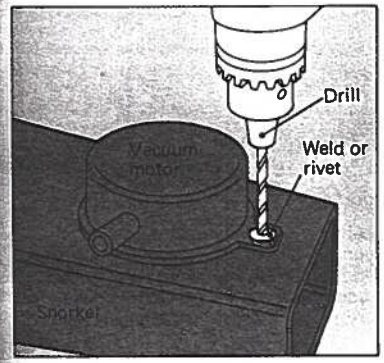


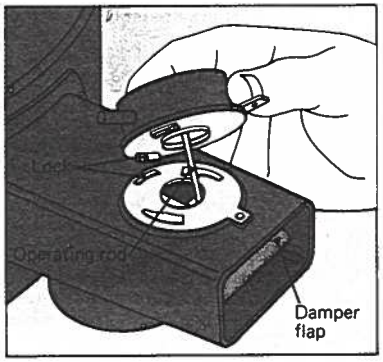
2. Disconnect the hose from the vacuum motor. Make sure that the hose is connected to the heat-sensing switch. If the hose is cracked, replace it. With the engine on, put an ice cube on top of the switch, let the switch cool, then feel for vacuum at the hose end. If there is no vacuum, replace the switch; if there is vacuum, replace the motor.





Heat-sensing switch replacement: Disconnect vacuum hoses from the switch and remove the air cleaner. Use a screwdriver to pry off the clips that hold the switch to the air cleaner. Remove switch and gasket. Install a new switch and gasket in the reverse order. Hold new switch by its outer edges; compress gasket to form a tight seal.

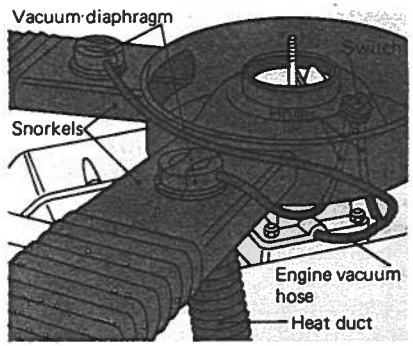




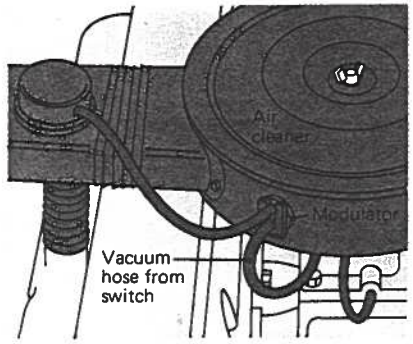
Vacuum motor replacement: Remove the air cleaner and disconnect the hose from the vacuum motor. Drill through the rivets or welds that hold the motor to the snorkel. Tip motor slightly forward to disengage lock, and rotate motor counterclockwise. To disengage the operating rod from the damper flap, slide the motor to one side. Install new vacuum motor in the reverse order. Use small sheet-metal screws to secure motor to snorkel.

Additional controls

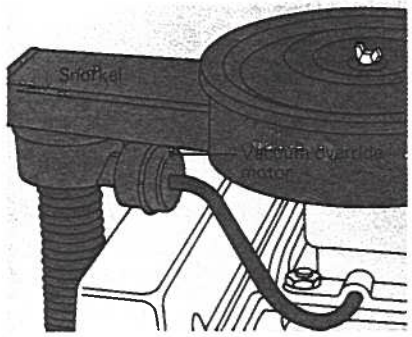
Some heat-controlled air cleaner systems have an additional control that affects the temperature and/or the amount of air that enters the system during acceleration, when engine vacuum is low. If your car accelerates poorly, this additional control may be defective and need to be replaced. Have it checked by a professional mechanic.



A dual-snorkel air cleaner has a damper flap in each snorkel. One snorkel is attached to the heat duct; the damper flap is controlled by the heat-sensing switch. The flap in the second snorkel is controlled by engine vaccuum. During acceleration, both flaps open to admit outside air.



Some Ford cars have a Cold-Weather Modulator on the side of the air cleaner, in the vacuum line between the heat-sensing switch and the vacuum motor. When the outside air is below 55° F (13° C), the modulator traps the vacuum to keep the flap closed to outside air while engine accelerates.



A vacuum override motor is connected to the flap inside the snorkel of some thermostatically controlled damper flap units. When a cold engine is accelerating, the vacuum diaphragm overrides the thermostat control to open the damper flap; this allows outside air as well as heated air to enter the system.

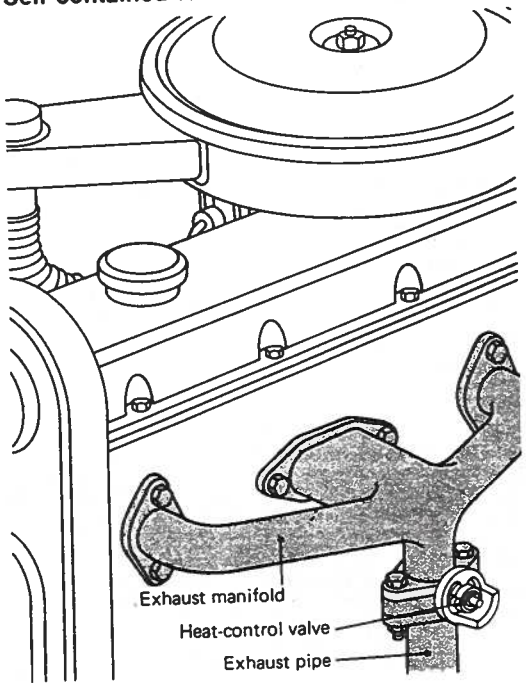
Types of heat-control valves

There are two types of heat-control (*riser*) valves: self-contained and vacuum controlled (p.57). Both types are controlled by a thermostatic device. A self-contained valve is moved by a bimetallic spring that flexes with changes in temperature. A vacuum-controlled valve is moved by a vacuum diaphragm and rod; the vacuum to the diaphragm is controlled by a thermal vacuum switch (TVS) that is in contact with engine coolant or oil. Shown at the right are the typical locations of heat-control valves and their controls on an in-line and a V-type engine. Either kind of engine can have either type of valve.

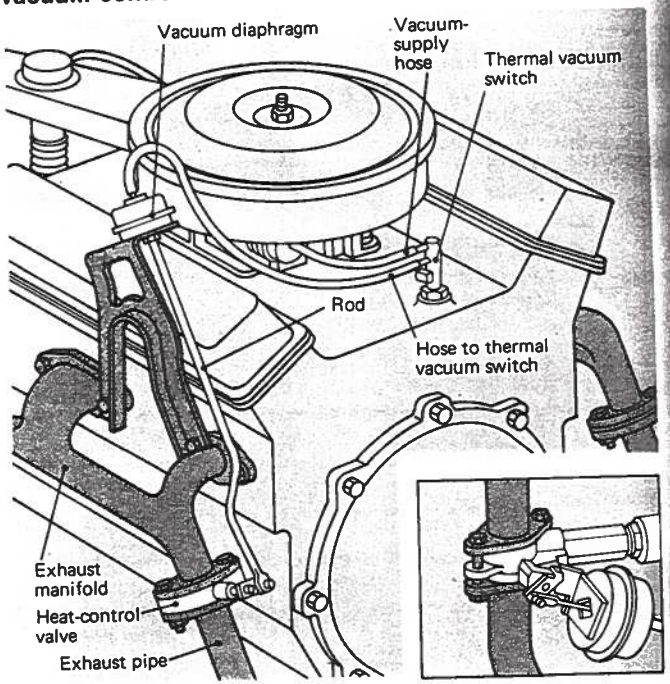
The most frequent malfunction with a heat-control valve is that it becomes sticky. This can be prevented by applying aerosol penetrating oil to the shaft at every tuneup. Sometimes the control must be replaced. Instructions for replacing a simple spring thermostat, a diaphragm, and a thermal vacuum switch are given on these pages. Removing the valve itself is a more complicated job that involves taking off the exhaust pipes (pp.434-438) and, on many engines, removing the exhaust manifold.

Tools: Hammer, long-nose pliers, wrenches, screwdrivers.
Materials: Heat-control valve lubricant, penetrating oil, sealant, replacement parts as needed.

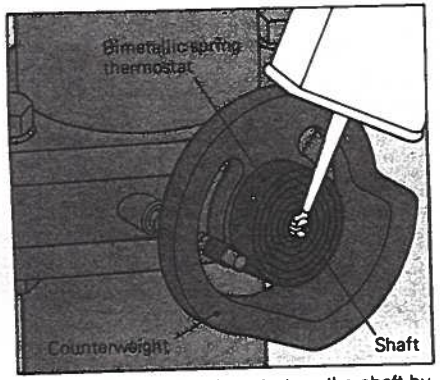
Self-contained valves on in-line engines



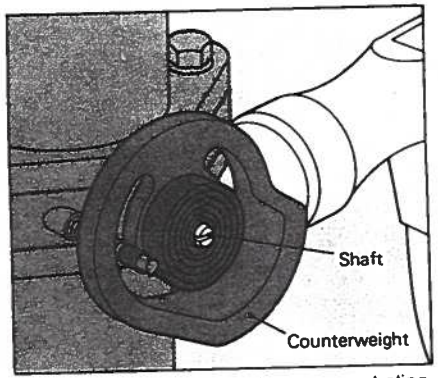
Vacuum-controlled valves in V-engines



Checking a self-contained valve 5–10 min

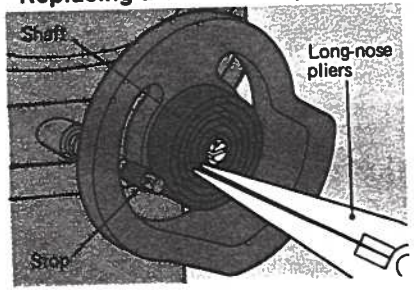


1. With the engine cold, try to turn the shaft by moving the counterweight by hand. If the valve sticks, apply penetrating oil to both ends of the shaft. Let the oil soak in, then work the shaft until it moves freely.

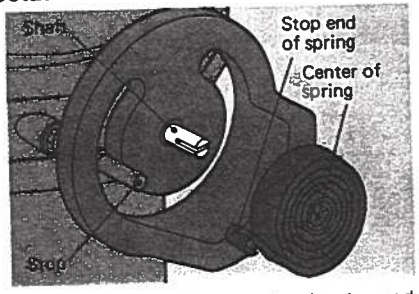


2. If the shaft still sticks, apply more penetrating oil to both ends of the shaft, let the oil soak in, then tap the shaft from side to side by hammering on the counterweight. Work the shaft by hand once more until it moves freely.

Replacing a bimetallic-spring thermostat

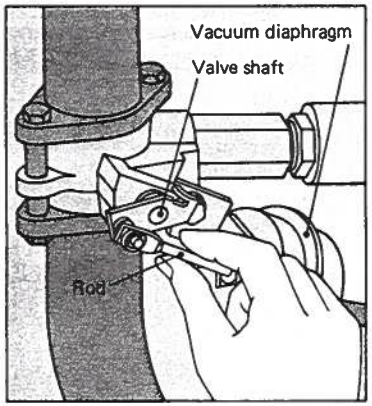


1. Grasp the center of the spring with long-nose pliers and pull it off the shaft. Remove the clip or pin holding the thermostat spring to the shaft, if necessary. The spring will automatically come off the stop.

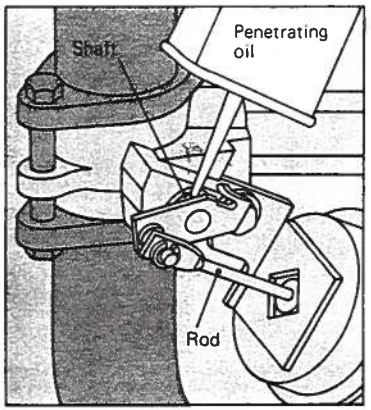


2. To install the new spring, align the stop end of the spring with the stop on the manifold, and fit the center of the spring to the shaft. Center usually fits into a slot in the shaft. If necessary, reinstall the retaining clip or pin.

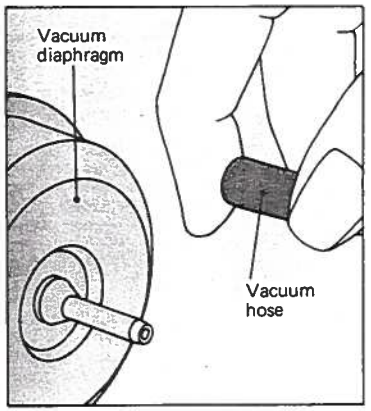
Checking a vacuum-controlled valve 10–20 min



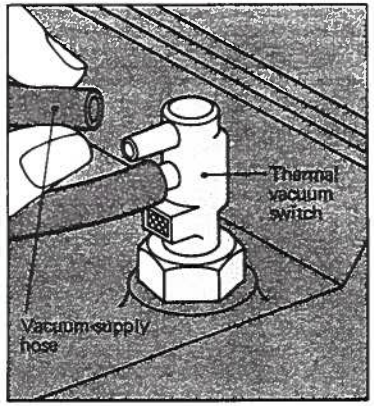
1. With engine cold, have a helper start the engine while you watch the rod that goes from the vacuum diaphragm to shaft of heat-control valve. Rod and shaft should move. If not, turn off engine and pull on rod to make sure that rod and shaft can move. Then skip to Step 3. **Caution:** Do not touch hot or moving parts; exhaust system heats up quickly.



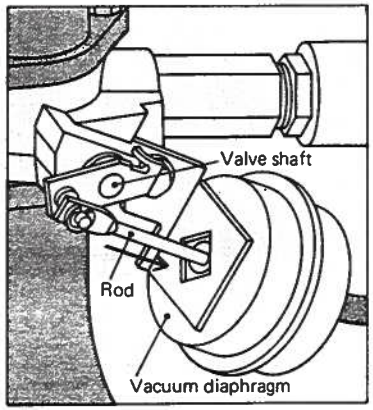
2. If rod and shaft will not move, apply penetrating oil to both ends of the shaft. Let the oil soak in, then work the rod and shaft until they move freely. Repeat Step 1. If there is still no movement, proceed to Step 3. If rod and shaft now move freely, skip to Step 5.



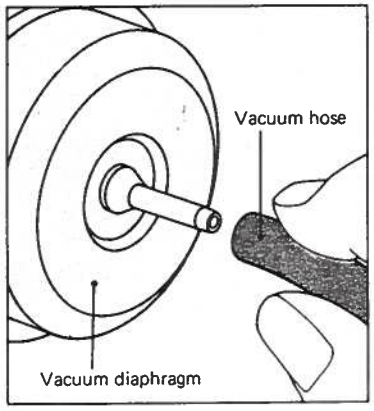
3. Let the engine cool, then start it up again. Disconnect the vacuum hose from the vacuum diaphragm and feel for vacuum at the hose end. If there is no vacuum, reconnect the hose and proceed to Step 4. If there is vacuum, turn off the engine and replace the diaphragm (right) before proceeding to Step 4.



4. Locate TVS by tracing hose from diaphragm. Start engine. Disconnect vacuum-supply hose from TVS. If there is vacuum at hose, turn off engine and replace TVS (right). If there is no vacuum, turn off engine and clean or replace the vacuum-supply hose. Make sure the other end of the hose is firmly connected. **Caution:** Do not touch hot engine parts.

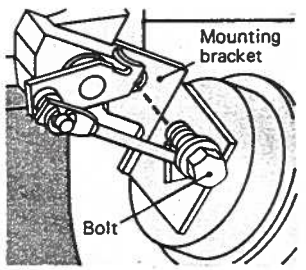


5. Let engine cool off, then turn it on again. Watch the rod and valve shaft as the engine warms up. When the engine has reached its normal operating temperature, the rod and shaft should move. If rod and shaft do not move, proceed to Step 6.

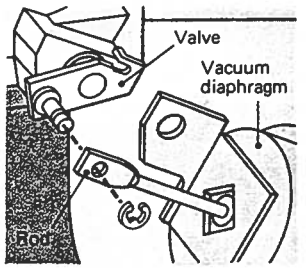


6. Turn engine on, disconnect vacuum hose from diaphragm, and feel for vacuum. If there is no vacuum, turn off the engine and replace the TVS (right). If there is vacuum, turn off the engine and replace the vacuum diaphragm (right). **Caution:** Do not touch hot or moving engine parts.

Replacing a vacuum diaphragm

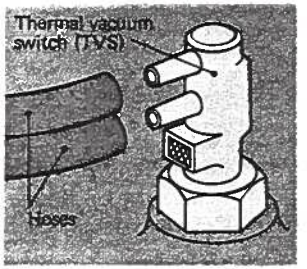


1. With the engine off and cold, disconnect the vacuum hose from the vacuum diaphragm. Remove the nuts or bolts holding the diaphragm to its mounting bracket.

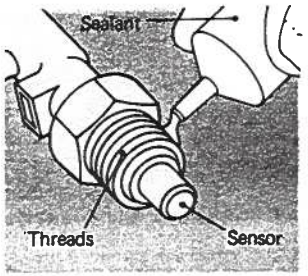


2. Disengage the rod from the valve shaft, and remove the diaphragm and rod. Reverse removal procedure to install a new diaphragm. Reconnect the vacuum hose to the diaphragm.

Replacing a thermal vacuum switch



1. With the engine off and cold, locate the TVS by tracing the hose from the vacuum diaphragm. Disconnect both hoses from the TVS. If TVS is in contact with coolant, drain coolant to below the level of the TVS (p.282).



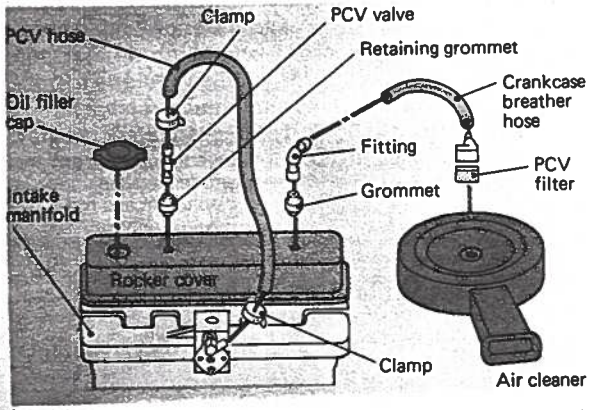
2. Unscrew the TVS from the engine; screw in the new TVS. If TVS is in contact with coolant, apply sealant to threads of switch (not to sensor). Reconnect the two hoses; add new coolant if necessary.

Servicing PCV systems 15–30 min

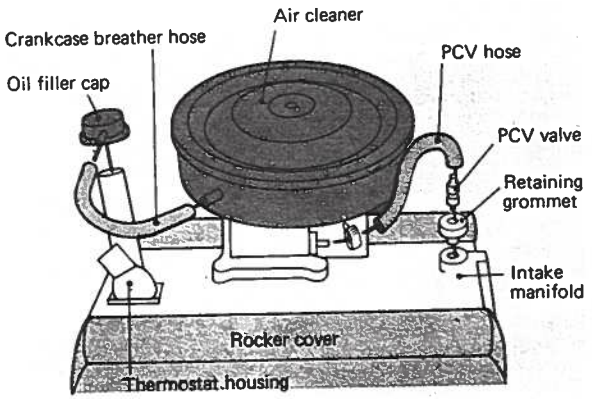
Positive crankcase ventilation (PCV) systems help to control automotive pollutants by drawing blow-by gases from the crankcase into the intake manifold, where they are mixed with the air-fuel mixture and burned in the engine (p.80). Yearly inspection and maintenance of the PCV valve, hoses, and filter helps to keep the system working properly. Illustrated below are six engines and the typical locations of PCV parts that need regular maintenance. Use the illustrations as guides to help you locate these parts on your engine. On many V-8s the PCV valve is mounted between the passages of the intake manifold. Specific maintenance procedures are given on the opposite page. If any parts are defective, replace them with new parts designed for your car model.

Tools and materials: Pliers, sheet of paper, solvent.

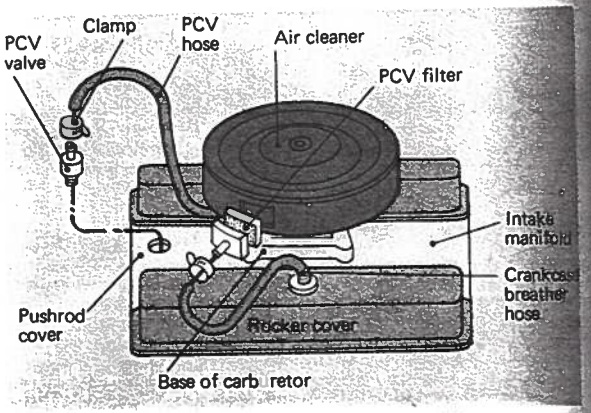
Typical locations of PCV parts



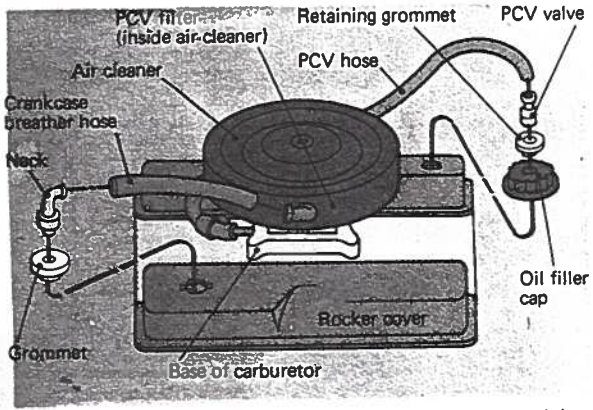
Many in-line six-cylinder engines have the PCV valve mounted in the rocker cover and held by a retaining grommet. The PCV hose runs from the PCV valve into the intake manifold. The crankcase breather hose extends from the rocker cover to the PCV filter inside the air cleaner.



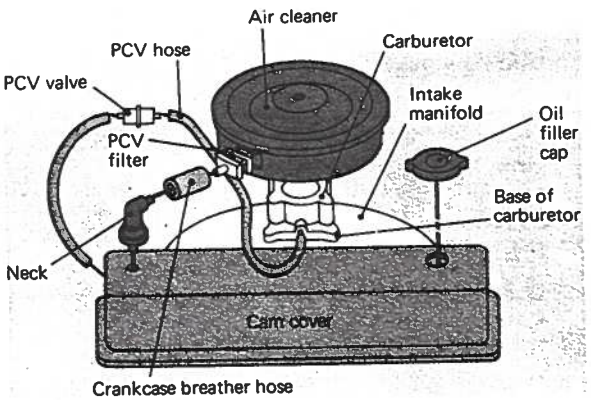
AMC V-8 engines have the PCV valve mounted in a retaining grommet in the intake manifold. The PCV hose goes from the PCV valve to the base of the carburetor. The crankcase breather hose runs from the air cleaner to the oil filler cap; there is a wire mesh filter inside the oil filler cap.



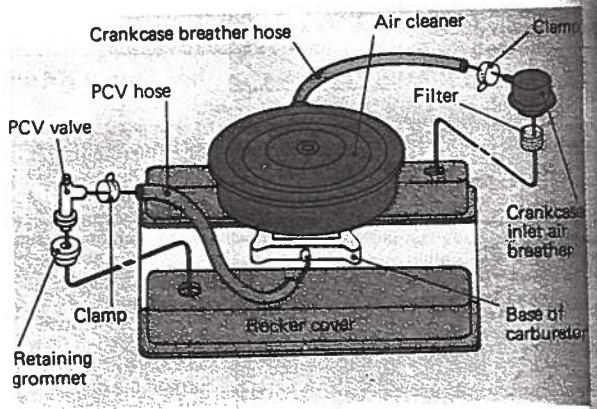
Some Pontiac V-8 engines have the PCV valve mounted in a retaining grommet in the pushrod cover, in front of the thermostat. The PCV hose connects the PCV valve to the intake manifold. The crankcase breather hose runs from the rocker cover to a PCV filter inside the air cleaner.



On many Ford V-8 engines the PCV valve is held by a retaining grommet to the oil filler cap, which is mounted on one of the rocker covers. The PCV hose runs from the PCV valve to the base of the carburetor. The crankcase breather hose runs from the other rocker cover to a PCV filter in the air cleaner.

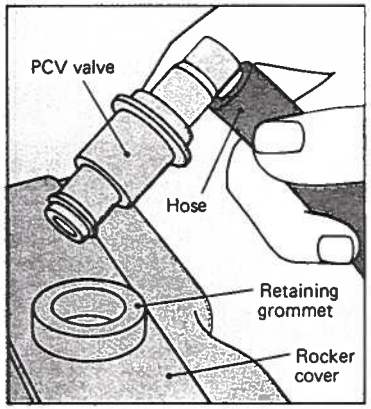


VW four-cylinder overhead camshaft engines used in AMC, Chrysler, and VW cars, have the PCV valve spliced into a hose that runs between the intake manifold and the base of the carburetor. The crankcase breather hose goes from the cam cover to a PCV filter inside the air cleaner.

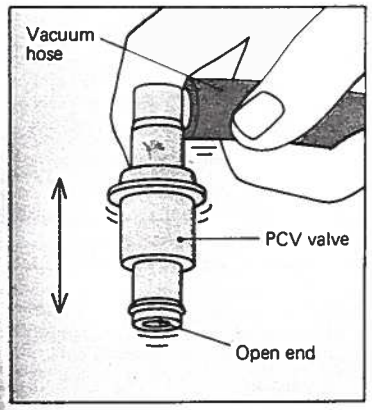


Chrysler V-8 engines have the PCV valve in a grommet in one of the rocker covers. The PCV hose runs from the PCV valve to the carburetor's base. The crankcase breather hose goes from the air cleaner to a crankcase inlet air breather on the other rocker cover. There is a filter inside the breather.

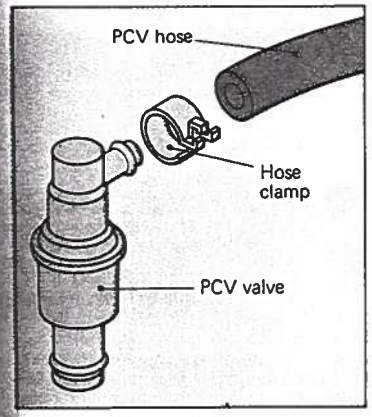
Inspecting and replacing a PCV valve and hose



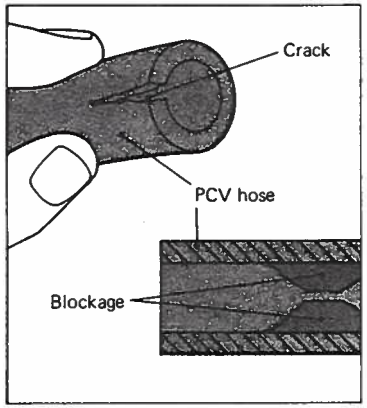
1. With the engine off, locate the PCV valve (see opposite page). Pull the valve out of its retaining grommet (shown). If the valve is spliced into a hose, pull the hose from one end of the valve.



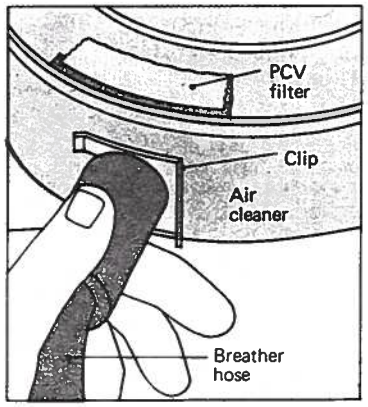
2. Shake the PCV valve. If you cannot hear its internal parts rattle, the valve is plugged and should be replaced. Even if the valve rattles, it may be bad. Run the engine with the valve connected to its vacuum source. If you cannot feel strong vacuum at the open end of the valve, replace it.



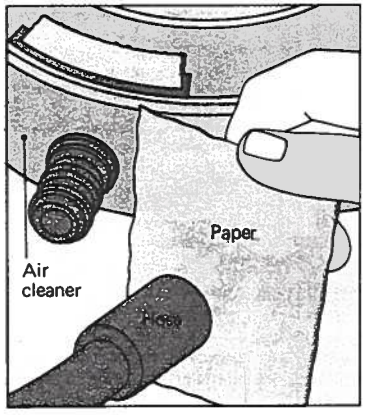
3. To replace a PCV valve, pull the valve out of its hose. It may be necessary to loosen a hose clamp before the valve will come out. Put a new valve into the hose; be sure that the new valve is facing in the same direction as the old one.



4. Inspect the PCV hose; if the PCV valve is spliced into the hose, be sure to inspect both sections of the hose. If the hose is cracked, blocked, damaged, or collapsed, remove the PCV valve and replace the hose. Then reinstall the PCV valve. Put the PCV valve back into its retaining grommet or other hose section.

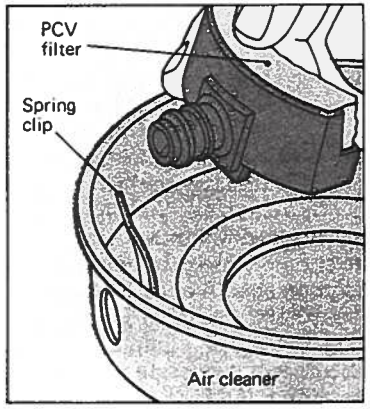


5. With the PCV valve and hose in place, disconnect the crankcase breather hose from the side of the air cleaner.

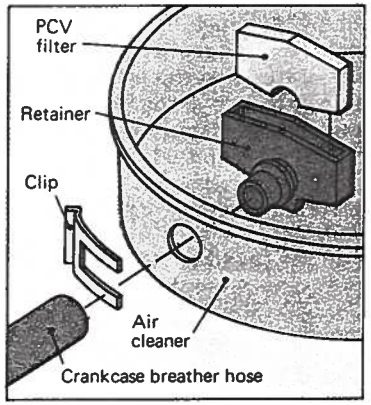


6. With the engine idling, put a piece of paper over the hose end. If vacuum does not hold the paper, the hose is clogged and should be replaced. If breather hose is connected to a crankcase breather or oil filler cap, the filter in the breather or cap may need replacing or cleaning (right). **Caution:** Do not touch hot or moving engine parts.

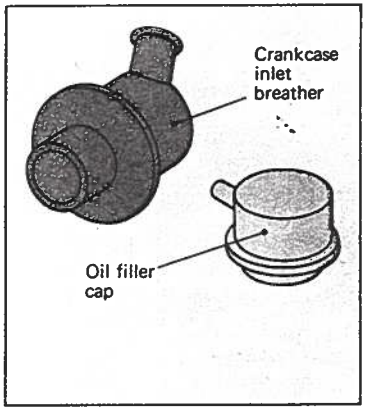
Inspecting and replacing PCV filters



1. The PCV filter is located inside the air cleaner. The filter should be removed and inspected periodically. First, remove the air cleaner cover and filter (p.240). If the filter is dirty, replace it. Some filters are held to the side of the air cleaner by a spring clip. Slip the old filter out of the clip; slip new filter in.



2. Other PCV filters sit in a retainer that is inside the air cleaner. Remove the air cleaner cover and the air filter (p.240). Then remove the clip that holds the crankcase breather hose to the outside of the air cleaner, and pull off the hose. Bring the retainer into the air cleaner; slip the PCV filter out of the retainer. Reverse order of removal to install a new filter.



3. Chrysler and AMC V-8 systems do not have a PCV filter in the air cleaner. Instead, Chrysler has a filter in the crankcase inlet air breather; AMC has a filter in the oil filler cap. To clean these filters, remove the breather or cap and disconnect any hoses that are attached. Then rinse the breather or cap with auto parts solvent. Let part dry before reinstalling it.